Session Title: GIS: What is it and why is it important? **(slide 1)**

Session Summary (slides 2 & 3)
Geographic Information Systems (GIS) are computer-based maps tied to detailed data about terrain, natural resources and man-made features. Global Positioning Systems (GPS) are devices that record geographic positions with varying degrees of precision. Used together, this technology can be extremely useful for trail planning and design, and related analysis, review, and management tasks. As with all technology, there are limitations, learning curves, costs and points of diminishing returns. This presentation and discussion will provide an overview and some case studies of several real-world GIS/GPS trail plans and designs. There will be a real-time demonstration of a GIS trail plan and its links to data tables and cost estimates.

There will be plenty of opportunities for questions and comments from attendees, and relating their own experiences.

Educational Objectives (slide 4)
Attendees will learn some practical considerations about how and when to use GIS and GPS for trail planning, design, and management.

Presentation Outline

1. Introduction: 10 Min.
(slide 6)
Basic characteristics of GIS **(slide 5)**
- ESRI/ArcView as standard, other varieties such as Manifold or GRASS (freeware).
- Maps can be viewed (but not edited) in ArcExplorer/ArcReader.
- Cost: $1,500 for basic license (low end) to $15,000 for advanced applications (high end).
- AutoCAD Map is an alternative – cost: $5,000.
- Learning curve/education sources – takes a real time commitment and technical specialization.
- Where to get help/contract: training at community colleges, universities, ESRI, private contractors.

GPS – Global Positioning Systems **(slides 6 & 7)**
- Finds points, which are used to create lines and areas.
- Accurately locates features in relationship to the earth as represented by a map.
- Done by triangulating positions from at least 3 satellites at known positions above the earth.
- Accuracy depends on the cost/quality of the GPS unit, and the number of satellites that can be picked up. Post processing is done in office.

- Cost varies from $200 for hand-held units to $5,000 for backpack units.
- Better in open country; worse under tree cover or in deep canyons.

Capabilities **(slides 8 & 9)**
- Can combine many types of data in infinite variety – aerial photography, topography, vegetation, property lines, streets, etc.
- Can do spatial analysis, techniques to examine and explore data from a geographic perspective, to develop and test models, and to present data in ways that lead to greater insight and understanding.
- Quantify, create summaries, 3D views, cross-sections, "live" interactive maps.
- Better for large-scale planning than for site-specific design – but with detailed data can be used for site design. AutoCAD is usually used for site design.
- Can be translated to AutoCAD, Adobe Illustrator/PDF with constraints and challenges, and to some extent be transferred back.
- Doesn't just create a picture.
- Potential for greater accuracy.
- Doesn't require high-end computer or equipment.

Considerations
- Complex to use – takes training and experience to create and manipulate complex maps and related data.
- Can be unstable – prone to freezing, crashing, etc. This is related to the complexity and number of processes used.
- Difficult to make graphic edits because data is also being reorganized. However, can create an image without attributing data to the object.

2. General GIS Q&A: 5 min. (slide 10)

3. What's Needed to Use GIS: 10 min.

Hardware and Software

Basic – can set up for under $5,000: **(slide 11)**
- Good computer, monitor
- Large format printer
- ArcView software

Higher-end – can cost up to $25,000 **(slide 12)**
ESRI has package deal for 1st 2 items for $12,600:
- Whiz-bang PC, e.g. HP xw6400, 3 ghz intel Xeon 5160 Dual Core with 4 MB, level 2 Cach3, 4 gb RAM, 19" flat panel with NVIDIA 256 MB Quadro

- ArcInfo software license (alone about $12,000) comes with many more tools than ArcView. Extensions, such as 3D tools, can be purchased for about $2,500 ea.
- Plotter for large format maps (HP 5000 Plotter 42" $12,500)

Staff and Training

Basic: **(slide 13)**
Community college GIS courses, classes at ESRI

Higher-end: **(slide 14)**
University degree with full courses and practice in GIS (usually Geography major, also Planning, Landscape Architecture, Natural Resources), a couple years on-the-job training

Contractors/Partners **(slide 15)**
Many colleges and universities; other agencies and organizations; many environmental planning firms, design firms, GIS contractors, GreenInfo Network

Base Data Types
Types of base data that are needed to prepare useful GIS/GPS trail maps and plans:
- Geographical Features **(slide 16)**
  - Topo – most useful. Can create from USGS Digital Elevation Model (DEM)
  - Soils/Geology
  - Vegetation
  - Hydrology – can derive from topo
- Man made/cadastral **(slides 17 to 19)**
  - Street center line/curbs
  - Parcels, right-of-ways
  - Utilities
  - Real estate/financial data
  - Jurisdictions
  - Demographic/census data
- Aerial Photography - needs to be orthorectified (ground controlled and corrected) for larger areas. **(slide 20)**

Base Data Sources **(slide 21)**
- United States Geological Survey (USGS) basic nationwide data
- California Spatial Information Library (CASIL) – Free base data for California including digital aerial photography, topographic maps, many statewide data sets.

- Many counties, some cities, have good GIS data – photography, topography, parcel lines (often have to purchase and/or sign licensing agreement)
- May be able to piggyback on someone else's data set
- U.S. Census Bureau - Tiger files for basic streets, addresses, demographic data
- Many online sources of satellite aerial photography for low cost
- For $10 - $20K can have 100 – 200 ac. site flown for detailed aerial topo, photo, boundaries

4. Examples of GIS Trail Plans: 15 min.

Regional **(slides 22 to 26)**
Show environmental types, land use, transportation systems, jurisdictions, demographics, overall mileages

Local **(slides 27 to 30)**
Show above, plus properties, physical conditions, opportunities and constraints; feasibility analysis; with generalizations can get into schematic design and cost estimation

Site-Specific **(slides 31 to 35)**
Show intimate details, specific design proposals, quantities, cost estimates. May be more efficient to use AutoCAD or combine w/AutoCAD and other media to illustrate. Specific design details for construction, or construction documents, require AutoCAD, but many trail projects have extensive area and generalized requirements that can be shown best with GIS.

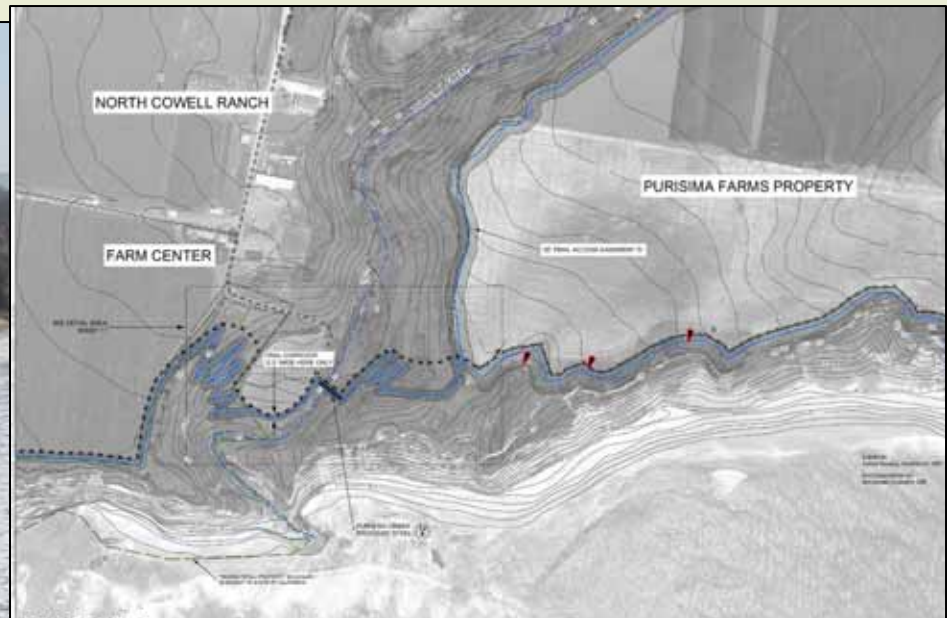## 5. On-Screen Demo – Sky Valley Cordelia Hills Trail Plan: 10 Min. (slide 36)

6. Specific GIS Q&A/Discussion: 15 min. (slide 37)

7. Summary: 5 min. (slide 38)
What was heard and learned? You tell us!

GIS for Trail Planning
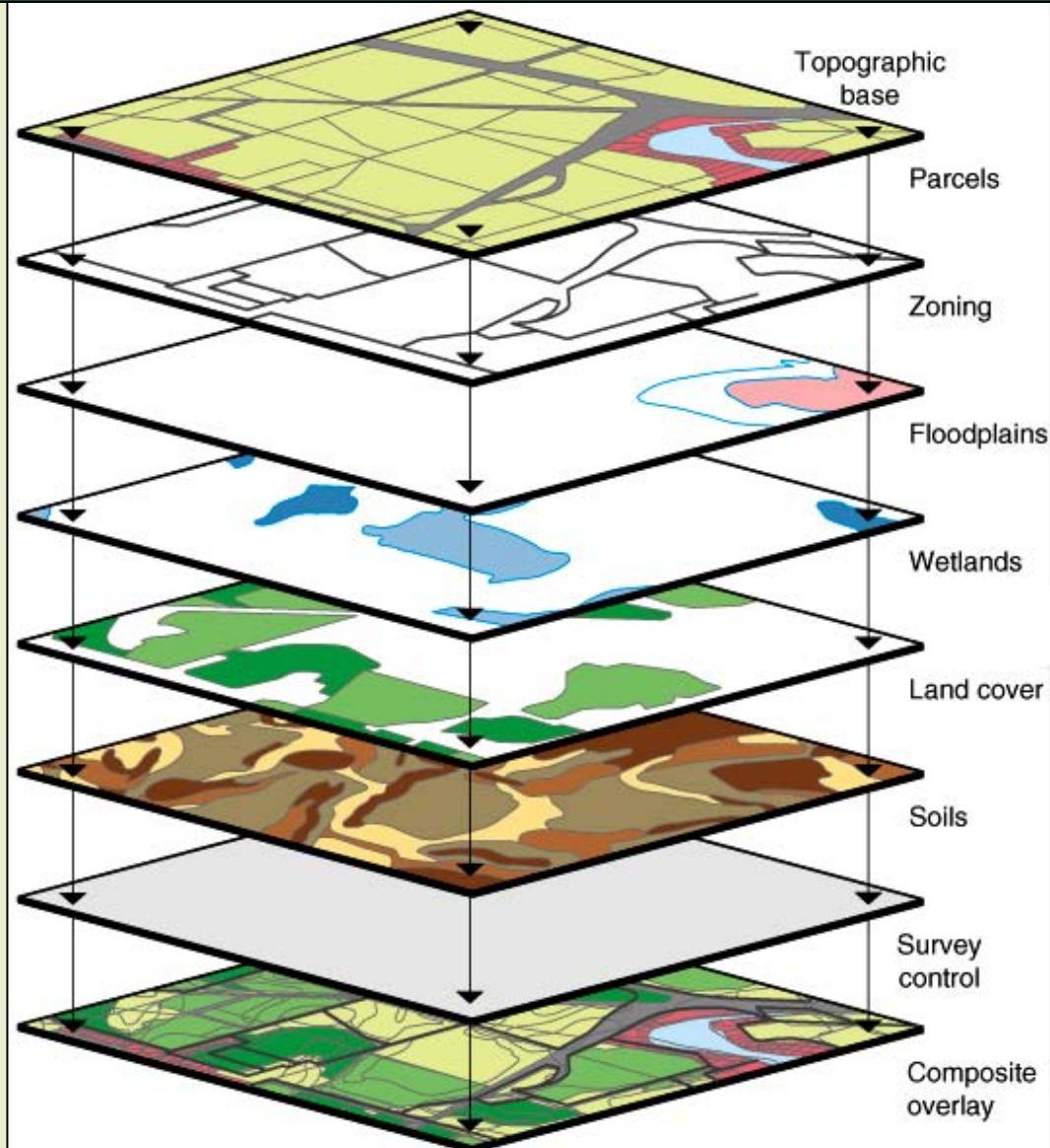
What is it and why is it important?

California Trails and Greenways Conference
May 12, 2007

LandPeople

Geographic Information Systems (GIS)

Topographic base
Parcels
Zoning
Floodplains
Wetlands
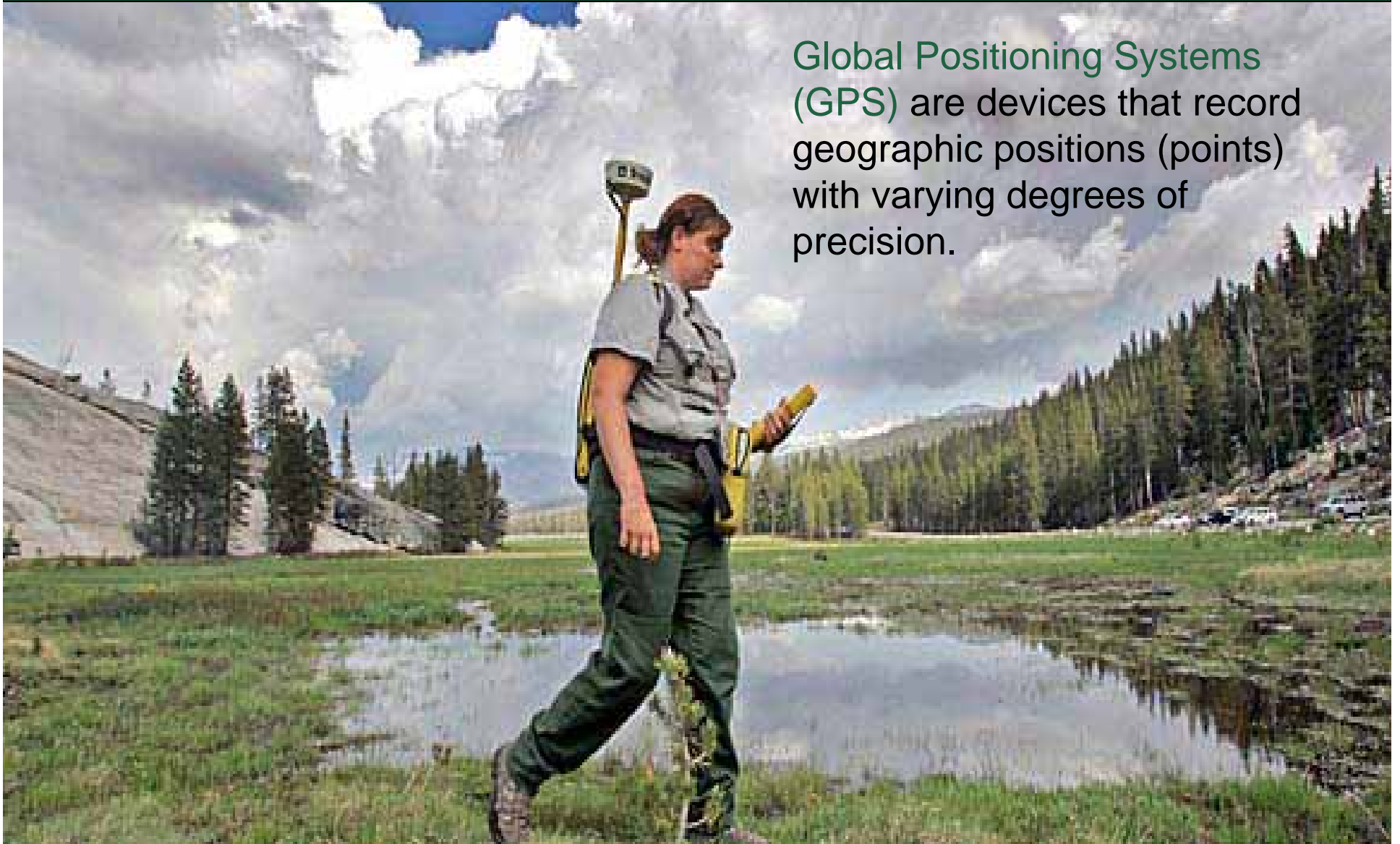**Land cover**
Soils
Survey control
Composite overlay

Geographic Information Systems (GIS) are computer-based maps tied to detailed data about terrain, natural resources and man-made features.

Global Positioning Systems (GPS)

Global Positioning Systems (GPS) are devices that record geographic positions (points) with varying degrees of precision.

Presentation Outline

1. Introduction – 10 min.

2. General GIS Q & A – 5 min.

3. What's Needed to Use GIS – 10 min.

4. Examples of GIS Trail Plans – 15 min.

5. On-Screen Demo – Sky Valley Cordelia Hills Trail Plan – 10 min.

6. Specific GIS Q & A / Discussion – 15 min.

7. Summary: What did you hear and learn? – 5 min.

Basic Characteristics of GIS

- ESRI/ArcView – industry standard/ near monopoly $1,500 for basic license

- Up to $15,000 for advanced applications

- Maps can be viewed (but not edited) in ArcExplorer/ArcReader

- Manifold GIS (inexpensive Windows-based, but its own learning curve)

- GRASS (freeware) limited capabilities.

- Google Earth – very limited tools, but good for sharing

- AutoCAD Map is an alternative – cost: $5,000.

ESRI

manifold.net

AutoCAD 2007

ArcView® GIS
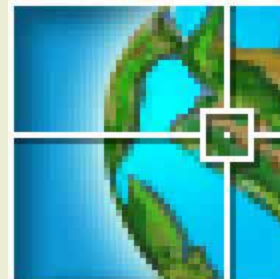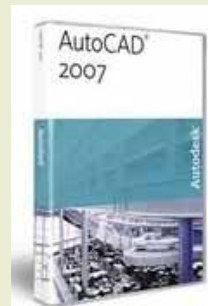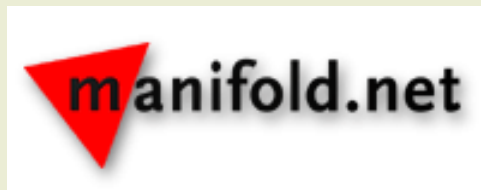
Basic Characteristics of GPS

▪Accurately locates points in relationship to the earth.

▪Takes readings from satellites at known positions above the earth.

▪Accuracy depends on the cost/quality of the GPS unit.

▪Cost varies from $200 for hand-held units to $10,000+ for backpack units.

Basic Characteristics of GPS

Accuracy is better in open country; worse under tree cover or in deep canyons.

GIS Capabilities

- Can combine many types of data.

- Can analyze a vast variety of factors.

- "Live" interactive maps.

- Can be translated to and from other map programs.

- Potential for greater accuracy, flexibility to update.

- Great for technical analysis, especially overlaying features.

- Great for public presentation – flexibility allows many different ways to present data.

GIS Considerations

▪Complex to use – need training and experience, continuous practice.

▪Can be unstable.

▪Difficult to make graphic edits.

Error

FATAL ERROR: RESTART YOUR LIFE IN MS-DOS MODE

OK   Cancel
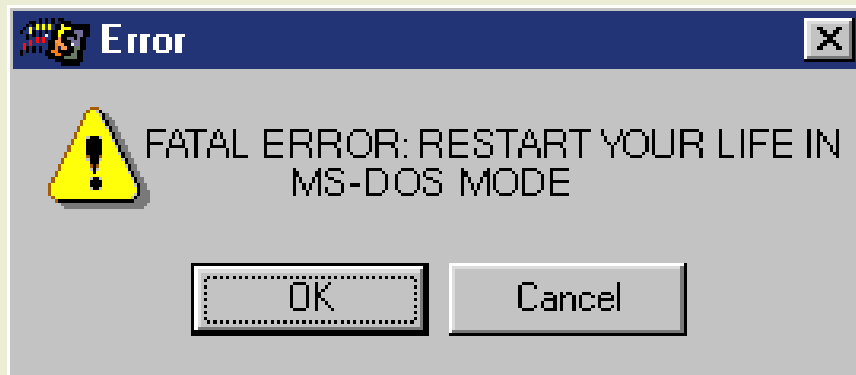
General GIS Q & A

What's Needed to Use GIS?

Basic Setup:

can set up for under $5,000

- Good computer, monitor

- Large format printer

- ArcView software

High-end Setup:

up to $25,000 for single station
(less per additional station):

- Whiz-bang PC(s)

- ArcInfo software license
  (about $12,000)

- Plotter for large format
  maps

Basic: **Part time,** **community college GIS courses, classes at ESRI**

Staff and Training

High-end:

University degree with full courses and practice in GIS (usually Geography major, or Planning, Landscape Architecture, Natural Resources), a few years on-the-job training
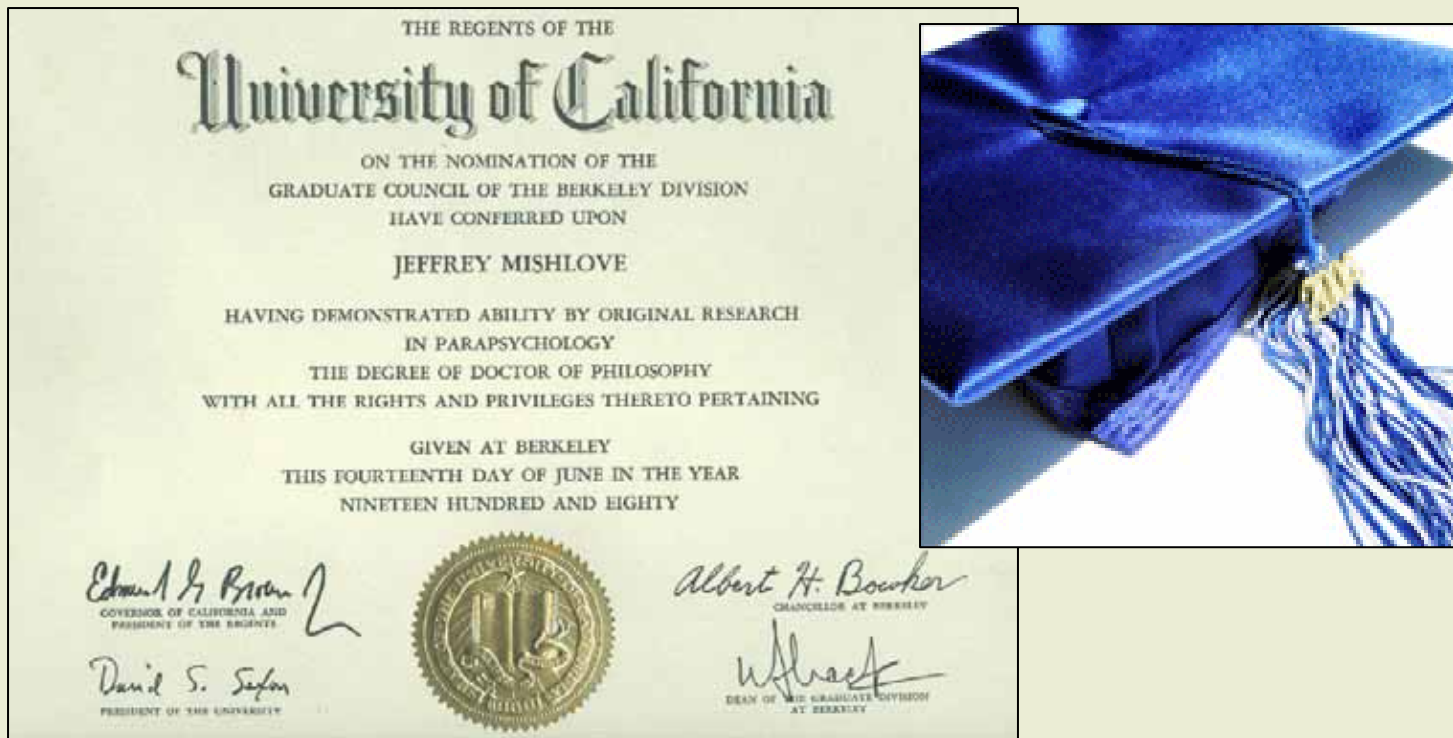
Potential Contractors/Partners

- **Many colleges and universities**

- **Many environmental planning firms, design firms**

- **GIS contractors (GreenInfo Network)**

- **Other agencies and organizations**
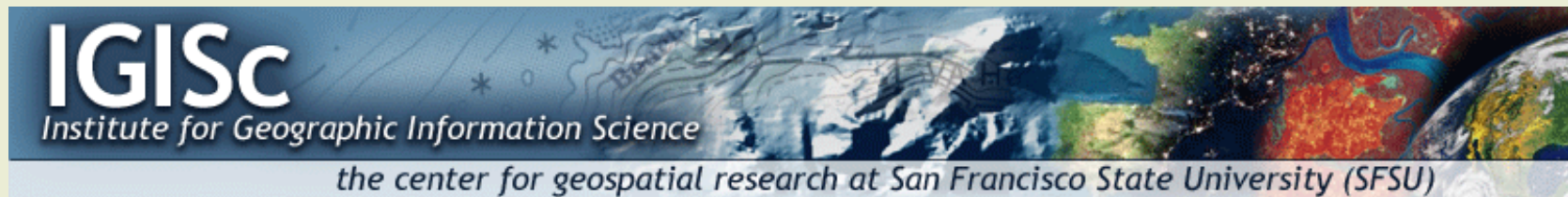
Base Data Types

Types of base data that are needed to prepare useful GIS/GPS trail maps and plans:

Geographical Features

Topography/Elevation Contour

Soils/Geology

Vegetation

Hydrology – can derive

from topo

Base Data Types

Types of base data that are needed to prepare useful GIS/GPS trail maps and plans:

Man Made/Cadastral

Street center line/curbs

Parcels, right-of-ways

Base Data Types

Types of base data that are needed to prepare useful GIS/GPS trail maps and plans:

Man Made/Cadastral

Utilities

Real estate/financial data

Base Data Types

Types of base data that are needed to prepare useful GIS/GPS trail maps and plans:

Man Made/Cadastral

Jurisdictions

Demographic/census data

Base Data Types

Types of base data that are needed to prepare useful GIS/GPS trail maps and plans:

Aerial Photography - needs to be orthorectified (ground controlled and corrected) for larger areas.

Base Data Sources

- United States Geological Survey (USGS)

- Many counties, some cities, have excellent data

- California Spatial Information Library (CASIL)

- Piggyback on someone else's data set

- U.S. Census Bureau

- Online satellite aerial photography

- Can have site flown for topo, photo, boundaries

Regional – Show environmental types, land use, transportation systems, jurisdictions, demographics, overall mileages
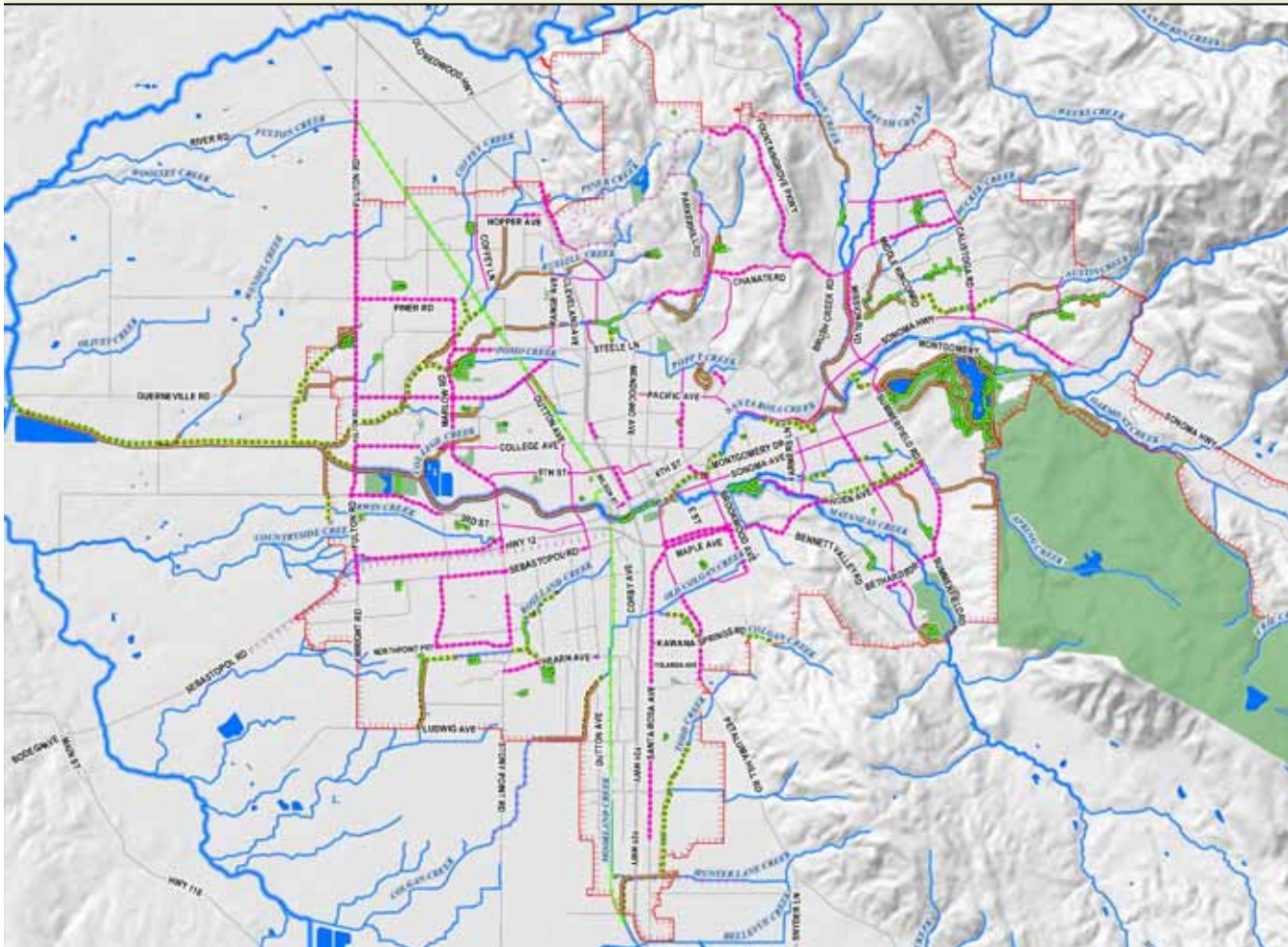

Solano Countywide Pedestrian Plan

Examples of GIS Trail Plans

Regional – Show environmental types, land use, transportation systems, jurisdictions, demographics, overall mileages
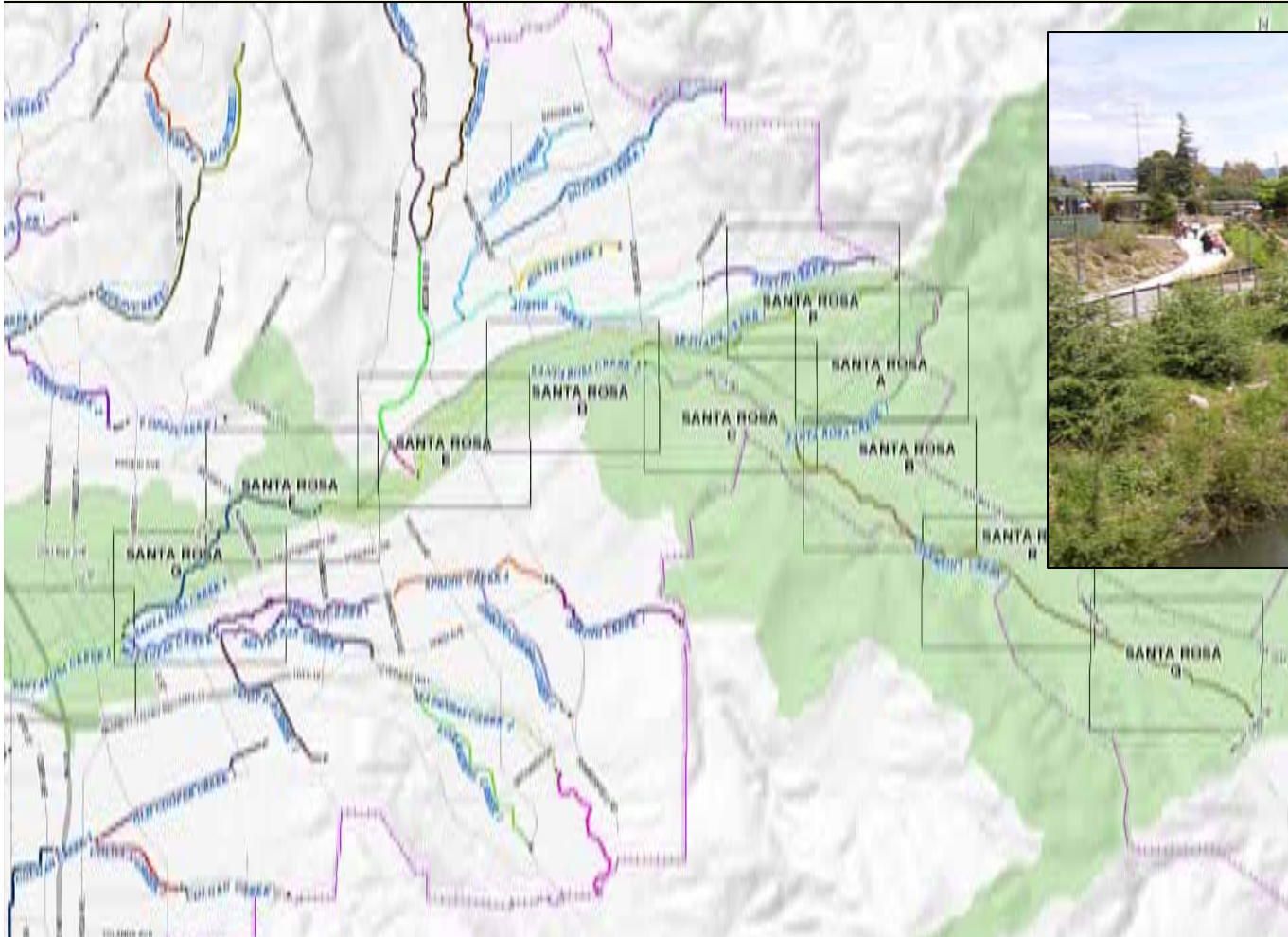

Solano Countywide Trails Plan
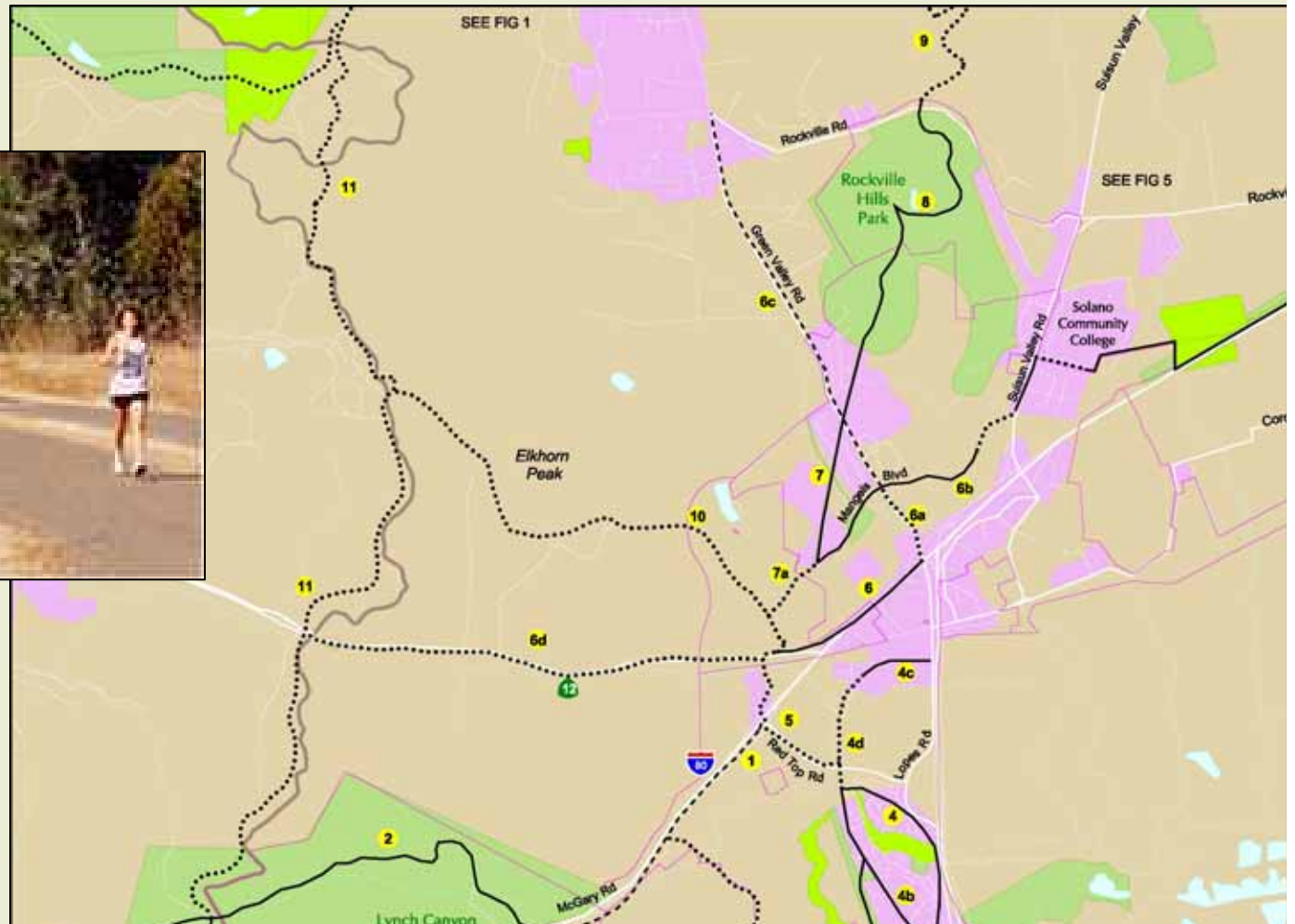
Examples of GIS Trail Plans

Regional – Show environmental types, land use, transportation systems, jurisdictions, demographics, overall mileages


*Santa Rosa
Citywide Creek
Master Plan*
overview map

Examples of GIS Trail Plans

Regional – Show environmental types, land use, transportation systems, jurisdictions, demographics, overall mileages

Santa Rosa Citywide Creek Master Plan **index map**

Regional – Show environmental types, land use, transportation systems, jurisdictions, demographics, overall mileages

Santa Rosa Citywide Creek Master Plan **detail map**
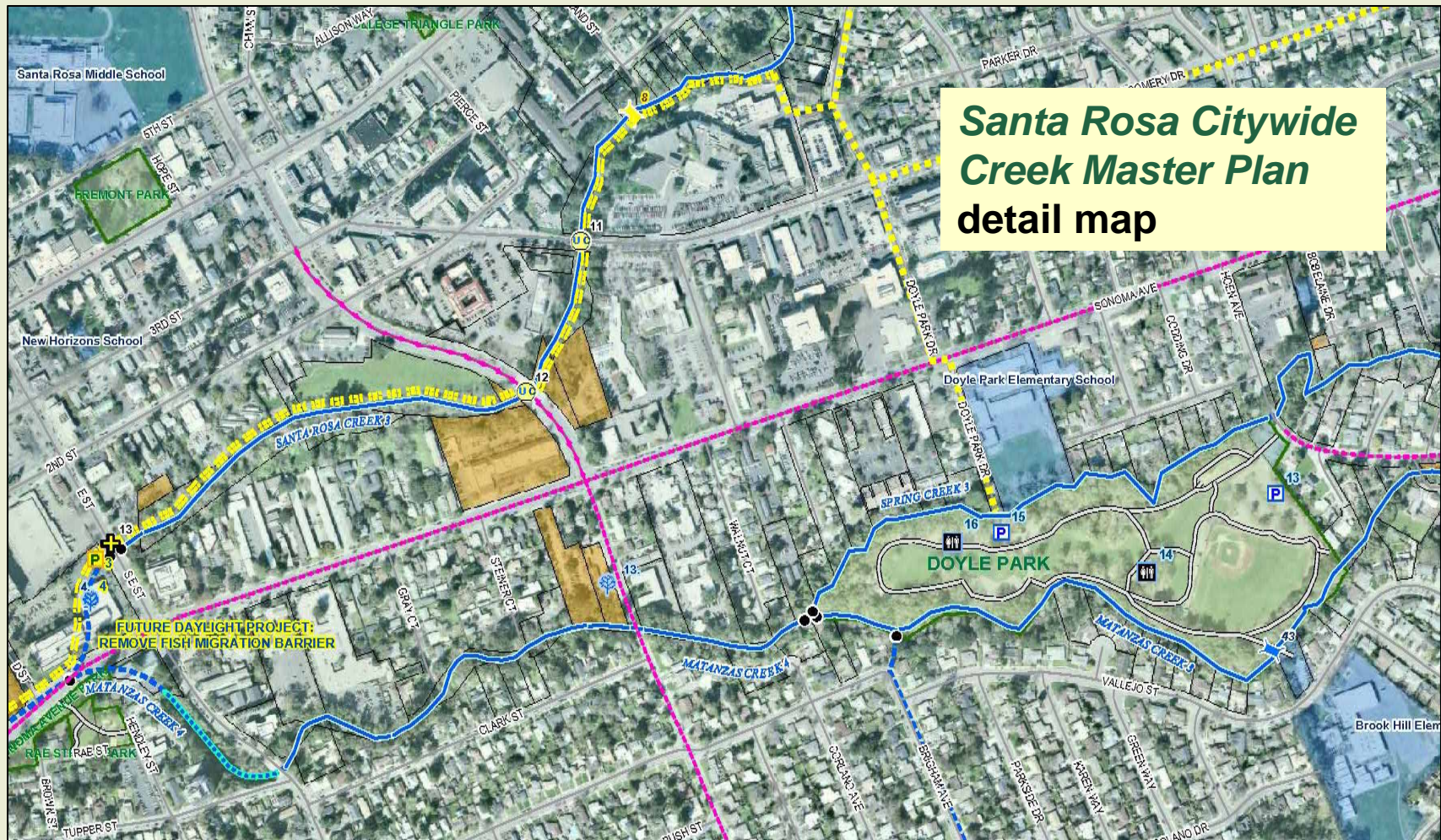
Examples of GIS Trail Plans

Local – Show regional features, plus properties, physical conditions, opportunities and constraints; feasibility analysis
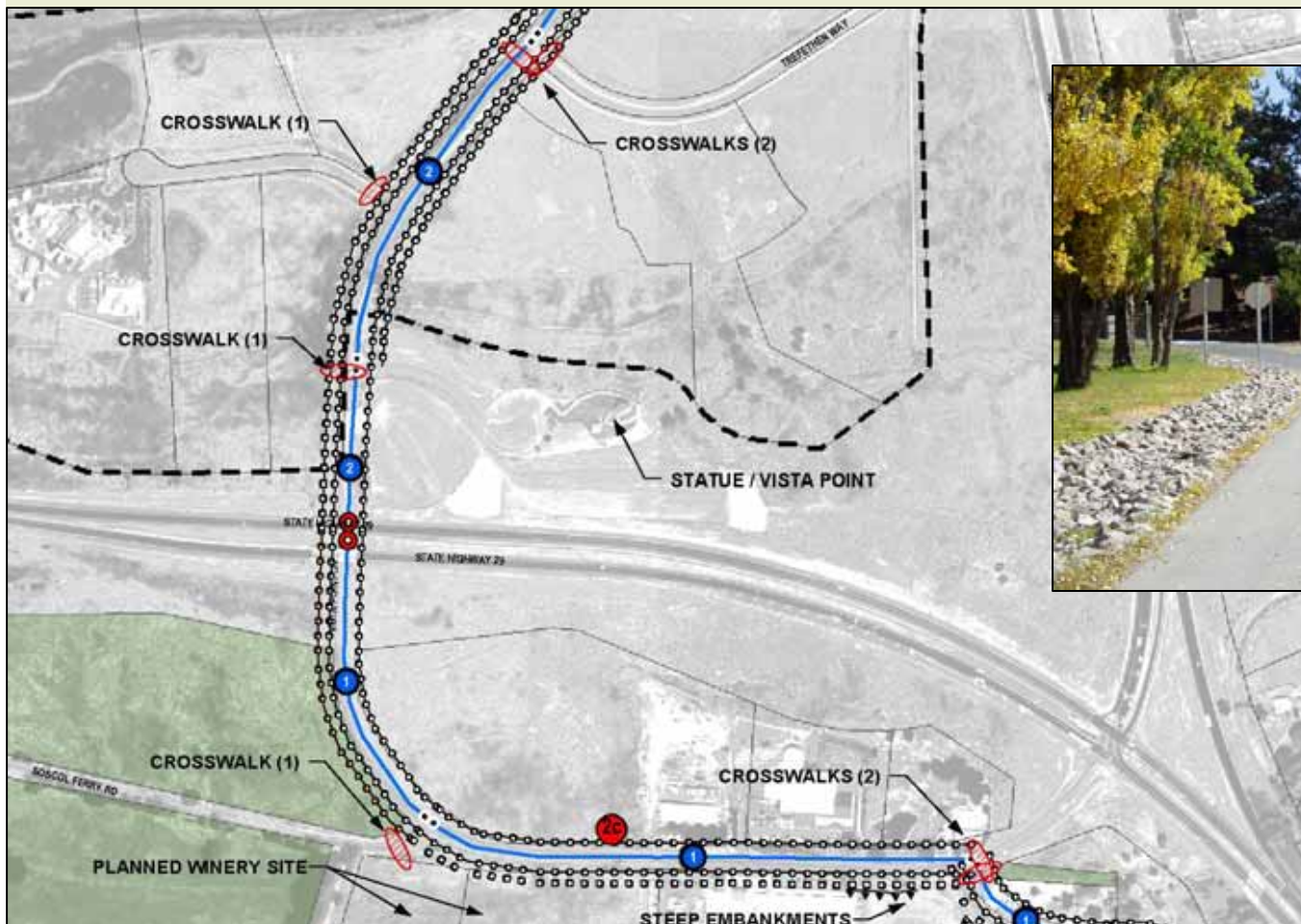

Walnut Creek Open Space Visioning Project
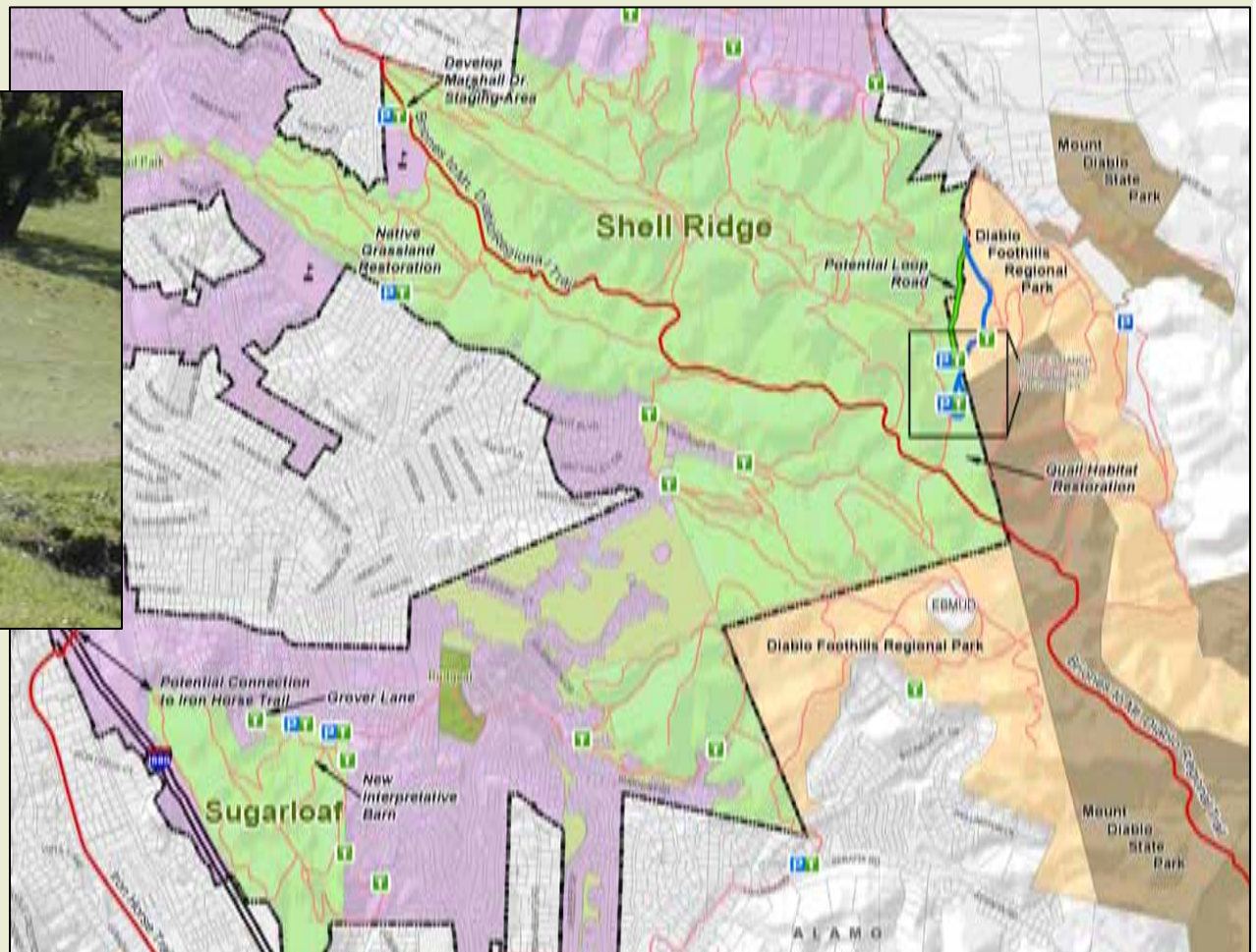
Examples of GIS Trail Plans

Local – Show above, plus properties, physical conditions, opportunities and constraints; feasibility analysis
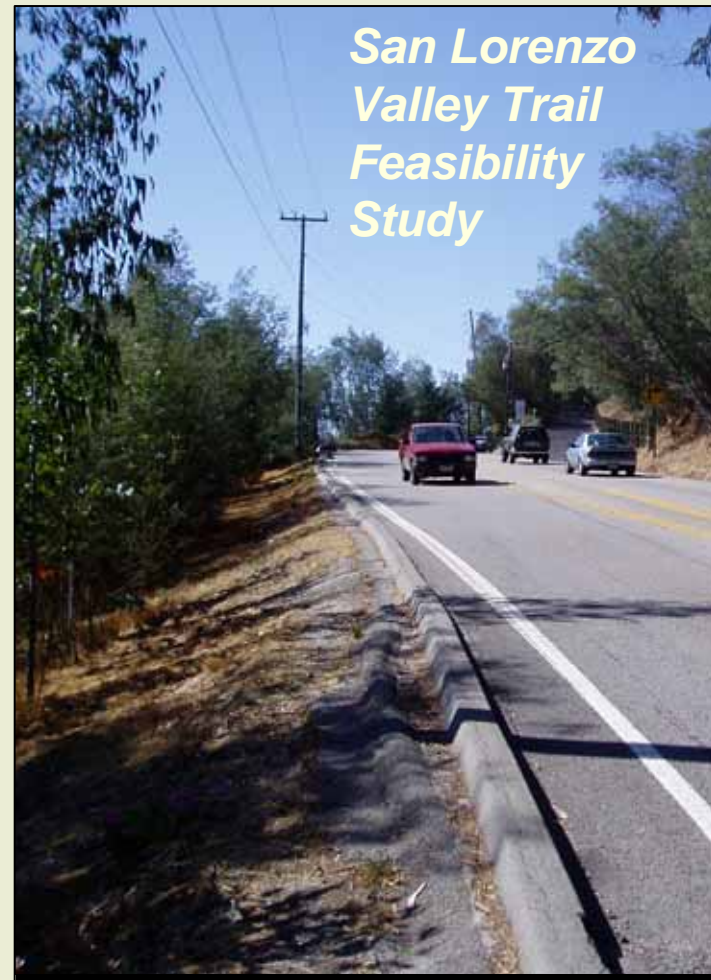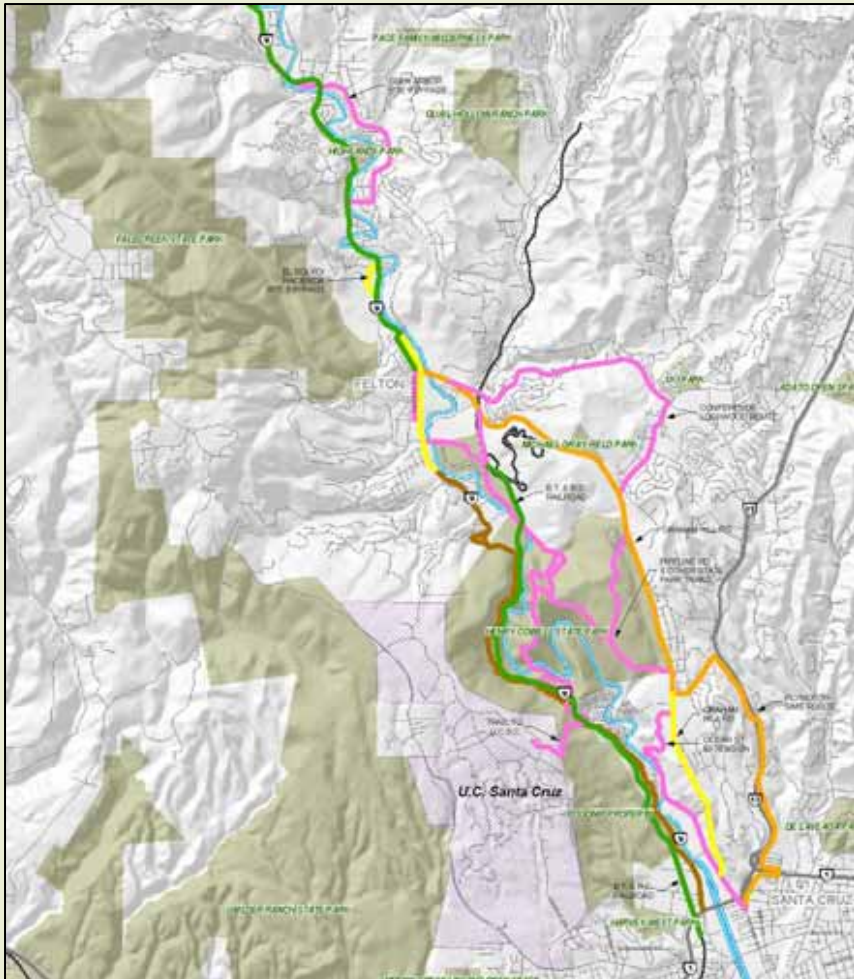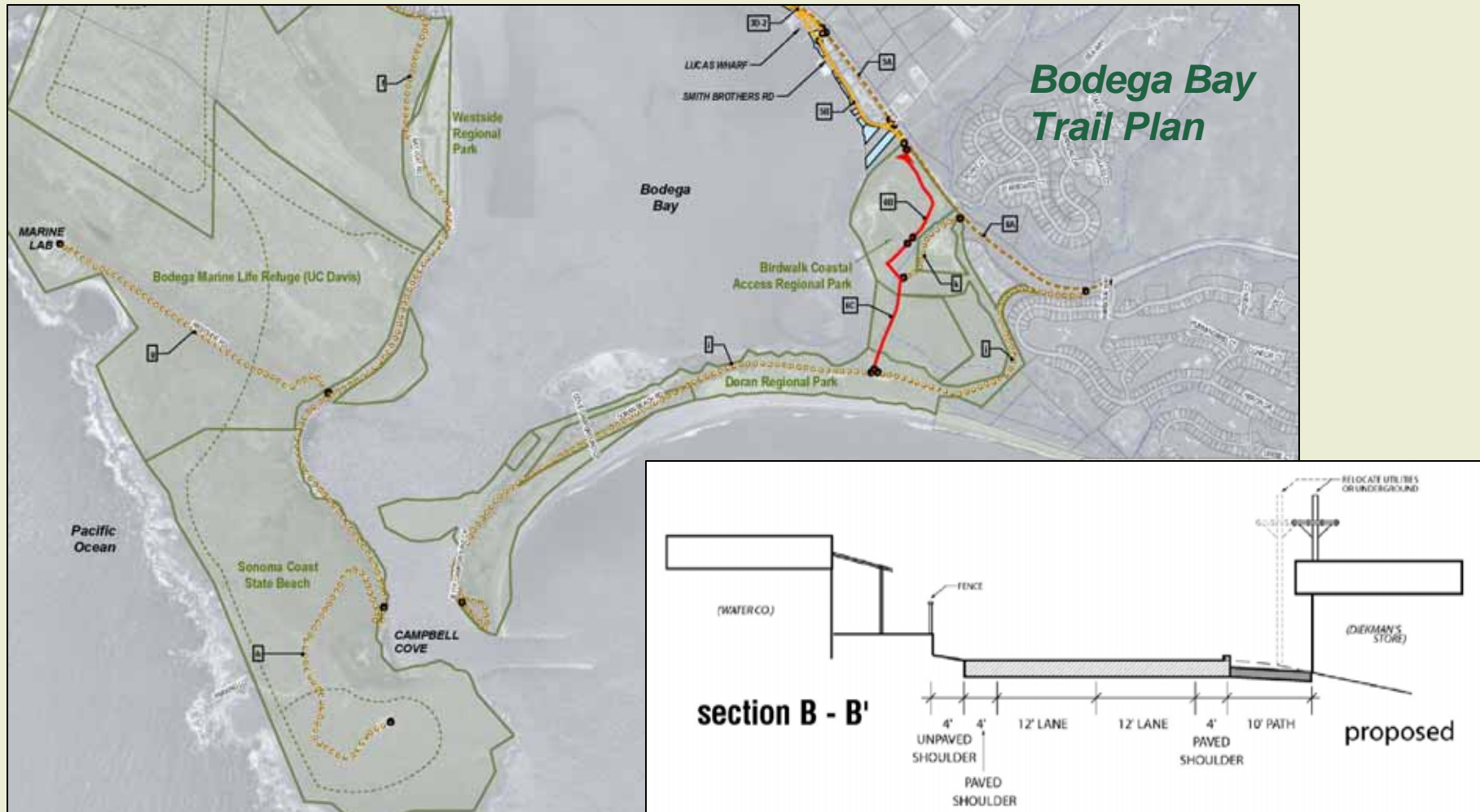

Napa Airport Area Bike Route Study

Examples of GIS Trail Plans

Local – Show above, plus properties, physical conditions, opportunities and constraints; feasibility analysis

San Lorenzo Valley Trail Feasibility Study

Examples of GIS Trail Plans

Local – Show above, plus properties, physical conditions, opportunities and constraints; feasibility analysis
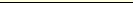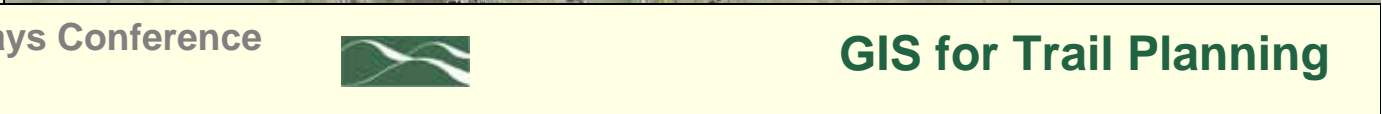

Bodega Bay Trail Plan

Examples of GIS Trail Plans

Site Specific – Show intimate details, specific design proposals, quantities, cost estimates

*Sky Valley-
Cordelia Hills
Trail Plan*

Examples of GIS Trail Plans

Site Specific – Show intimate details, specific design proposals, quantities, cost estimates
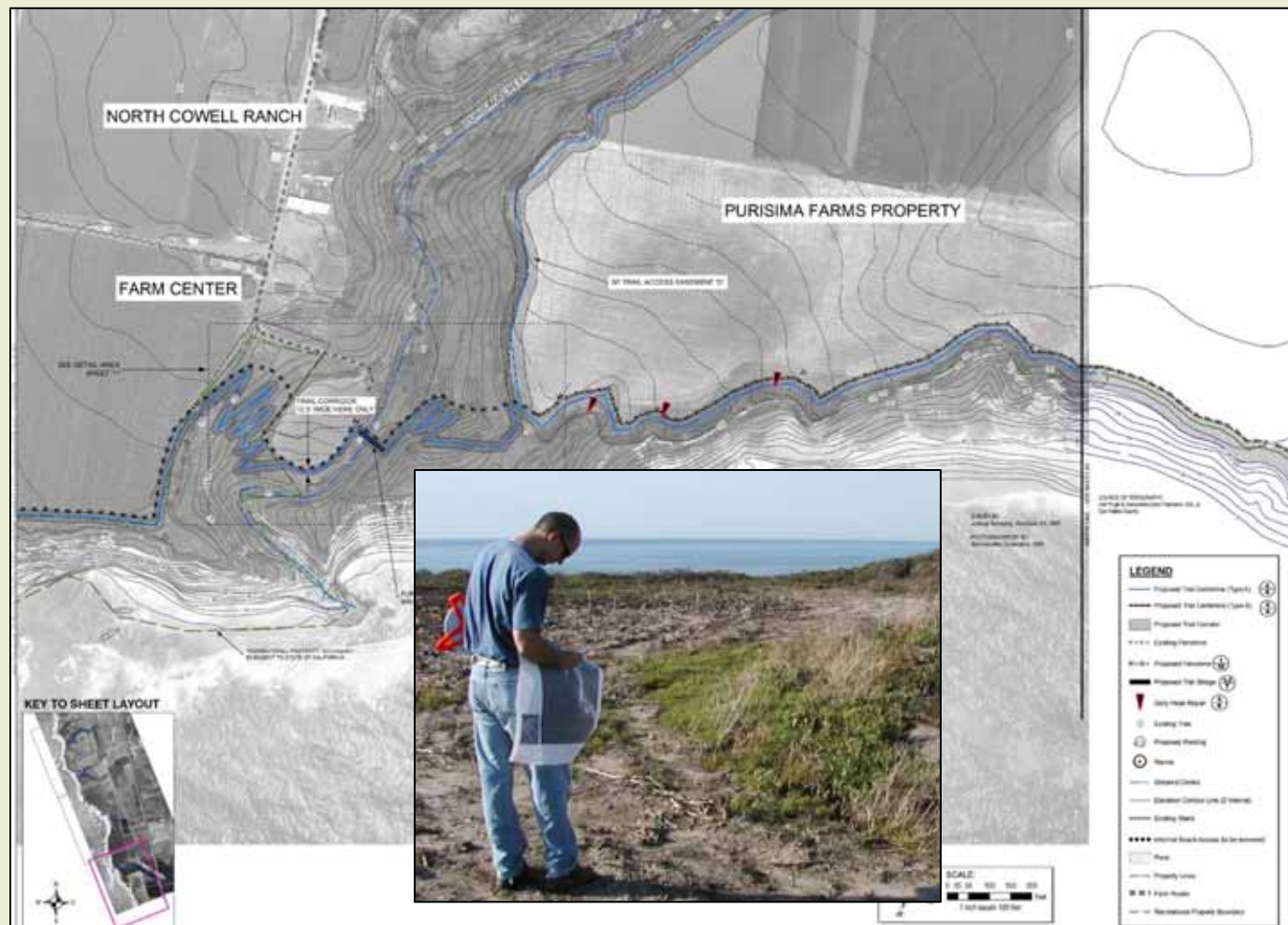

Napa-Solano Ridge Trail

Examples of GIS Trail Plans

Site Specific – Show intimate details, specific design proposals, quantities, cost estimates

Cowell Ranch-Purisima Farms Coastal Trail

Site Specific – Show intimate details, specific design proposals, quantities, cost estimates

Pillar Point Bluff Access Plan

LF	Width in feet	SF
2,828	12	33,936
1,460	5	7,300
4,689	12	56,268
1,579	5	7,895
707	8	5,515
3,759	12	45,108
5,875	5	29,375
827	12	9,924
2,230	5	11,150
480	12	5,760
24,434		212,230
13,171		101,317

Examples of GIS Trail Plans

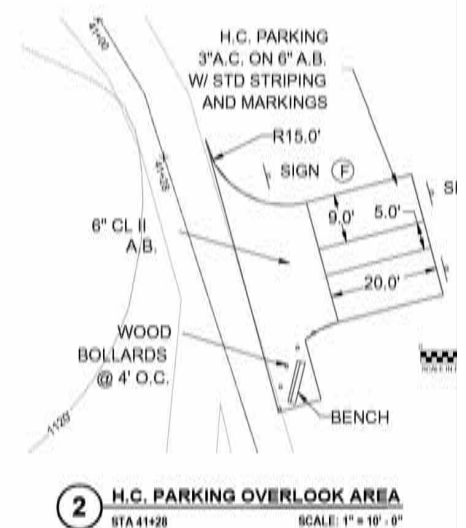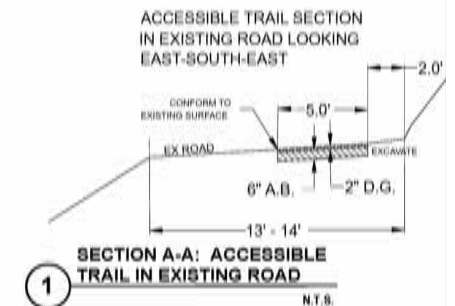**Site Specific** – Show intimate details, specific design proposals, quantities, cost estimates

Sonoma Mountain Ridge Trail Public Access & Staging Area Project

On-Screen Demo – Sky Valley-Cordelia Hills Trail Plan

California Trails and Greenways Conference
LandPeople

GIS for Trail Planning

Specific GIS Q & A / Discussion